PATENT SPECIFICATION 797,435

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Date of filing Complete Specification : May 18, 1956.

Application Date : June 17, 1955. No. 17616/55.

Complete Specification Published : July 2, 1958.

Index at Acceptance :—Class 108(3), S6(E3 : F).

International Classification :—F06f.

COMPLETE SPECIFICATION.

Improvements in or relating to Vibration-Absorbing Devices.

We, METALASTIK LIMITED, a British Company, of Evington Valley Road, Leicester, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns vibration-absorbing devices and relates more particularly to devices for supporting the centre bearing of a transmission shaft for a road vehicle such as a motor car, lorry or bus.

The invention has reference to devices of the type comprising a pair of nested members and a ring member of rubber or the like resilient material between the members so that one member is supported from the other. In one arrangement of such a device the resilient ring member has been provided with grooves, holes or recesses of such size and so disposed as to provide a required local stiffness and furthermore by selecting the relative stiffness in various places (e.g. around a bearing carried by the second member) it may be arranged that a required ratio of stiffness in different directions is obtained. Said grooves or the like have been exposed so that dirt and oil may lodge therein. An accumulation of dirt in the groove may ultimately effect the local stiffness of the vibration-absorbing material while oil which lies in the grooves may attack the material.

Broadly the object of the invention is the provision of a device of the type set forth in which the known disadvantages referred to are reduced or eliminated and to this end, according to the invention, a device of the type set forth is characterised in that the ring member (which is independent of the outer nested member at least) has at least two separate circumferentially-spaced pockets the only access to which is through an opening in either or both peripheral surfaces of the ring member, the opening or openings of each pocket being closed against ingress of extraneous matter by one or other, or both, of said nested members, each pocket being empty.

Various practical applications of the invention will be described, by way of example only, with reference to the accompanying drawings which diagrammatically illustrate a support device for the centre bearing of a transmission shaft for a road vehicle.

In the drawings:—

Fig. 1 is an end view, partly in section, of one construction of device in accordance with the invention;

Fig. 2 is a section on the line II—II of Fig. 1;

Fig. 3 is an end view of a support device showing two alternative constructions thereof, partly in section;

Figs. 4, 5 and 6 are views corresponding with Fig. 2 and showing alternative constructions of support devices;

Figs. 7 to 14 show various arrangements of the vibration-absorbing material;

Fig. 15 is an end view of part of a support device according to this invention;

Figs. 16, 17 and 18 are views similar to Fig. 2 showing alternative arrangements according to this invention;

Fig. 19 is a side view, partly in section, of another arrangement of the vibration-absorbing material; and

Fig. 20 is a section on the line XX—XX of Fig. 19.

Referring to Fig. 1: the support device comprises an inverted U-shaped member 20 having lugs 21 by which it may be attached to a bracket 22 or the chassis of the motor vehicle. The device also comprises a ring 23 mounted within the member 20, the ring 23 being adapted to receive a bearing by which the transmission shaft is directly sup-

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ported. The members 20, 23 constitute the pair of nested members referred to above. The bearing may, for example, be a ball or roller bearing in which case the outer race is received within the ring 23. The member 20 is provided to support the ring 23 by means of a member 24 of vibration-absorbing material. Conveniently the member 24 is of natural or synthetic rubber. The member 24 is moulded in the form of a D-ring having a split face, at 25, so that it may be readily passed around the ring 23 whereupon the member 20 is placed in position to secure the D-member 24 in position between the member 20, the bracket 22 and the ring 23. If desired the member 24 may be pre-compressed during assembly.

During manufacture of member 24 it is formed with pockets 26 extending inwardly from its inner peripheral surface and with pockets 27 extending inwardly from its outer peripheral surface. Alternatively either pockets 26 or 27 may alone be provided. It will be observed that the pockets 26, 27 are staggered and as shown in Fig. 2 the sides of the pockets are extended to engage either the ring 23 or the member 20 or the bracket 22 as is appropriate. In this way the mouths of the pockets are closed, the pockets being empty however, so that ingress to the pockets is prevented. Consequently dirt and oil cannot enter the pockets.

As shown in Fig. 2 the member 20 is formed with a raised edge at 28, one on each side of the D-member 24, and the upstanding portions of the pockets are held in position by said edges this further ensuring that the member 24 cannot be displaced so that dirt and oil enters the pockets.

The pockets may be evenly spaced around the axis 29 as shown or the spacing between adjacent pockets may be different. Moreover, the size of the pockets may be the same or different but in any event it is possible so to select the pockets that any required ratio of stiffness in different directions is obtained.

In Fig. 3 there is shown a member 24 in the form of a strip which, according to the construction on the right hand side of the Fig., extends completely around the ring 23, the strip being provided with pockets 26 and 27 as in the construction of Fig. 1. The member 24 is held in position around ring 23 by a strap 30 having lugs 31 for attachment to a bracket 32 and by a second strap 33 similarly attached to the bracket 32 by lugs 31*a*.

The construction shown in the left hand side of Fig. 3 is generally the same as that shown on the right hand side wherein, however, the member 24 is in two parts comprising a lower strip 34 and an upper strip 35.

The construction shown on the left hand, or right hand, side of Fig. 3 may be readily adapted for suspension entirely below brackets 32 by extending the lugs 31, 31*a* upwardly.

In Fig. 4 the member 38 of vibration-absorbing material is located between a strap or ring 20 having outwardly-flared sides 36 and a ring 37 of convex form in cross-section as shown in the drawing. The member 38 has pockets 39 and the sides of the pockets engage with the flared sides 36, the sides of the pockets being somewhat outwardly flared, the divergent edges of the sides engaging the flared sides of ring 37. As in the previous constructions the pockets are sealed against ingress of dirt and oil.

It will be observed that the radius *a* of the ring 37 is less than the minimum radius *b* of the flared sides 36 so that, if necessary, the ring 37 may be axially removed from within the strap 20. Alternatively, however, the dimension *a* may be slightly greater than the dimension *b* so that it is impossible to separate the ring from the member 20 thereby providing a safety device which prevents inadvertent separation of said parts.

In an alternative construction it may be arranged that the ring 37 is formed with a concave face and that the strap 20 has a convex face directed towards the ring 37. Again as in the construction of Fig. 4 the radii of the ring and the surrounding strap may be such as to prevent inadvertent axial separation.

In Fig. 5 a bearing-carrying ring 40 is provided with an outwardly-projecting circumferential rib 41 and a pair of ring elements 42 of vibration-absorbing material are provided, each being formed with pockets 43. The ring elements are held in position, at least in part, by a strap or like member 44 which is provided with inwardly directed edges 45 for this purpose. Again it will be observed that the mouths of the pockets 43 are completely enclosed against ingress of dirt and oil. If desired the rings 42 may be bonded or otherwise integrally attached to the ring 40. Such an arrangement is shown in Fig. 6 wherein the ring, which is indicated by the reference numeral 46, is formed from a strip, as by rolling, to provide an upstanding rib 47. The ring elements 42 are held in position as in the construction of Fig. 5 the strap or the member not being shown in Fig. 6.

In the construction of Fig. 5 radius *a* may be greater than radius *b* as shown to prevent inadvertent separation of parts 40, 44.

Figs. 7, 8, 9, 10 and 11 diagrammatically illustrate different forms which members 24, 34, 35 and 38 may take. In each of the arrangements shown in Figs. 7, 8, 9, 10 and 11 the vibration-absorbing material is preferably in the form of a strip produced by moulding in lengths or in any other known or convenient manner. By production in

lengths (and by continuous production) the cost of these strips may be kept low, any required portion being cut from the lengths so produced for use in any particular assembly.

In Fig. 12 there is illustrated a strip of vibration-absorbing material comprising blocks 48 joined together by side portions 49, the strip being bonded to a thin metal band 50 thereby to define pockets 53 lying between the side portions 49, the blocks 48 and band 50. A composite strip as shown in Fig. 12 may be wrapped around the ring 23 with the metal band 50 against the ring (in the manner of Fig. 15) or alternatively the composite strip may be wrapped around the ring with the blocks 48 next to the ring. In the latter arrangement the ring which carries the centre bearing will close the mouths of the pockets 53 and in the former arrangement an encircling strap or the like will be provided, as in the previous constructions, to close the pockets.

Fig. 13 shows a strip of similar construction to that of Fig. 12 wherein, however, there is provided a backing 55 which with blocks 48 and side portions 49 form the pockets 53. The backing 55 is bonded or otherwise attached to band 50.

In Fig. 14 a strip of vibration-absorbing material comprises side portions 51 of a synthetic resin material secured to, or held in position by pressure in fitting, a corrugated, castellated or similarly formed base 52 so as to define pockets 54. The material of the portions 51 is selected so as to be particularly resistant to oil and abrasion by dust and dirt while the material of the base 52 is selected because of its load-carrying characteristics e.g. a natural rubber. In the arrangement of Fig. 14 therefore the features of oil resistance and load-carrying capacity are separately provided for and suitably combined.

It is to be understood that a construction somewhat similar to Fig. 14 may be utilised in any of the constructions previously described.

In Fig. 15 there is shown a composite strip of vibration-absorbing material, such as that of Figs. 12 or 13, wherein the band 50 or backing 55 is wrapped around to form a split ring. Alternatively, the ends of the band or backing may be united to form a hoop and according to yet a further arrangement a strip of material such as of Figs. 7 to 10 is mounted upon a complete ring or tube.

In Figs. 16, 17 and 18 the strip material is not located between abutments, such as the edges 28 of Fig. 2 or the flared sides 36 of Fig. 4, but is held in place either by compression of the rubber between the central ring and the encircling strap or the like or alternatively the strip is stretched in such a way that it will firmly engage said parts. With either procedure the strip may additionally be secured to the parts, as by bonding.

It will be understood that the strips of Figs. 16, 17 and 18 may be of any convenient shape or form.

Another arrangement of vibration-absorbing means for use in a device such as illustrated in Figs. 1 and 2 is shown in Figs. 19 and 20.

In each of the arrangements described the rubber ring member is independent of at least the outer nested member by which is meant that the cavities in the rubber ring member are not used to interlock said ring with the outer nested member. Such an arrangement is specifically excluded from this invention.

What we claim is:—

1. A vibration-absorbing device comprising a pair of nested members and a ring member of rubber-like material between the nested members, the ring member (which is independent of the outer nested member at least) having at least two separate circumferentially-spaced pockets the only access to which is through an opening in either or both peripheral surfaces of the ring member, the opening or openings of each pocket being closed against ingress of extraneous matter by one or other, or both, of said nested members, each pocket being empty.

2. A vibration-absorbing device according to Claim 1 wherein there is a plurality of angularly spaced pockets in both abutted faces of the ring member.

3. A vibration-absorbing device according to Claim 1 wherein a plurality of angular-spaced holes extend through the ring member from one abutted face to the other, the ends of the holes being closed by said members.

4. A vibration-absorbing device as claimed in Claim 1, 2 or 3 in which the ring member is in the form of a D-ring split to fit over the inner nested member.

5. A vibration-absorbing device as claimed in Claim 1, 2 or 3 wherein the ring member comprises one, or more, strips of material extending around the inner nested member.

6. A vibration-absorbing device as claimed in Claim 5 in which the strip, or strips, is, or are, bonded or otherwise integrally united with either the inner or outer nested member.

7. A vibration-absorbing device according to Claim 6 wherein the strip is integrally united with a metal band, the assembly of the strip and the band being wrapped around the inner nested member with the metal strip engaging said member.

8. A vibration-absorbing device as claimed in Claim 6 wherein the strip is integrally united with a metal band, the

united strip and band being wrapped around to form a ring for assembly on one nested member, the other nested member being comprised by said band.

9. A vibration-absorbing device as claimed in Claim 7 or 8 wherein the strip comprises a continuous backing, side walls integral with the backing and upstanding therefrom and spaced blocks between the walls and integral therewith and with the backing, the latter being bonded to the metal band.

10. A vibration-absorbing device according to Claim 7 or 8 in which the strip comprises a pair of spaced, continuous, substantially parallel side walls and blocks between the walls and integral therewith, the pair of side walls and the blocks being bonded to the metal band.

11. A vibration-absorbing device as claimed in any preceding claim wherein the ring member has outwardly-flared sides.

12. A vibration-absorbing device according to any preceding claim in which the sides of said ring member engage outwardly-flared sides of one of the nested members, the sides of said nested member overlapping the sides of said ring member.

13. A vibration-absorbing device as claimed in any preceding claim wherein the ring-member comprises a pair of ring elements arranged side by side and parallel, the adjacent faces of the ring elements having pockets.

14. A vibration-absorbing device as claimed in Claim 13 wherein one of the nested members is extended to overlap the outer side faces of the ring elements to hold the elements in position between the members.

15. A vibration-absorbing device as claimed in Claim 13 or 14 in which the adjacent faces of the ring elements are separated by a rib on one of the nested members.

16. A vibration-absorbing device as claimed in any preceding claim wherein the sides of the ring member are of a synthetic resin material, the material of said ring member between the sides being of natural rubber.

17. A vibration-absorbing device as claimed in Claim 1 in which the ring member is held between the nested members by compression of the ring member by the nested members.

18. A vibration-absorbing device according to Claim 1 wherein the ring member is stretched and thereby held between the nested members.

19. A vibration-absorbing device as claimed in Claim 17 or 18 in which the ring member is bonded to either or both members.

20. A vibration-absorbing device according to any preceding claim in which the minimum internal diameter of the outer nested member is less than the maximum outer diameter of the inner nested member so that inadvertent separation of said members is prevented.

21. A vibration-absorbing device substantially as hereinbefore described and as illustrated in Fig. 1 and 2 or Fig. 3 or Fig. 4 or Fig. 5 or Fig. 6 or Fig. 15 or Fig. 16 or Fig. 17 or Fig. 18 of the accompanying drawings.

22. A vibration-absorbing device as claimed in Claim 1 wherein the resilient means is substantially as hereinbefore described and illustrated in Figs. 7, 8, 9, 10, 11, 12, 13, 14 or 19 and 20 of the accompanying drawings.

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PROVISIONAL SPECIFICATION.

Improvements in or relating to Vibration-Absorbing Devices.

We, METALASTIK LIMITED, a British Company, of Evington Valley Road, Leicester, do hereby declare this invention to be described in the following statement:—

This invention concerns vibration-absorbing devices and relates more particularly to devices for supporting the centre bearing of a transmission shaft for a road vehicle such as a motor car, lorry or bus.

It is known to provide a vibration-absorbing device comprising a support member, a second member to be supported by the support member and a block, pad, strip or the like of rubber-like vibration-absorbing material between said members and this invention relates to such supports (hereinafter referred to as supports of the type set forth). In supports of the type set forth it is known to provide a block or the like of vibration-absorbing material with grooves, holes or recesses of such size and so disposed as to provide a required local stiffness and furthermore by selecting the relative stiffness in various places (e.g. around a bearing carried by the second member) it may be arranged that a required ratio of stiffness in different directions is obtained. Said grooves or the like have been exposed so that dirt and oil may lodge therein. An accumulation of dirt in the groove may ultimately effect the

local stiffness of the vibration-absorbing material while oil which lies in the grooves may attack the material.

Broadly the object of this invention is the provision of a support of the type set forth in which the known disadvantages referred to are reduced or eliminated.

According to this invention a support device is characterised in that the block, pad, strip or the like of vibration-absorbing material is selectively formed with a pocket (or pockets) the opening to which (or each of which) is closed by said support and/or second member.

Various practical applications of the invention will be described, by way of example only, with reference to the accompanying drawings which diagrammatically illustrate a support device for the centre bearing of a transmission shaft for a road vehicle.

In the drawings:—

Figure 1 is an end view, partly in section, of one construction of device in accordance with the invention;

Figure 2 is a section on the line II—II of Figure 1;

Figure 3 is an end view of a support device showing two alternative constructions thereof, partly in section;

Figures 4, 5 and 6 are views corresponding with Figure 2 and showing alternative constructions of support devices;

Figures 7 to 14 show various arrangements of the vibration-absorbing material;

Figure 15 is an end view of part of a support device according to this invention; and

Figures 16, 17 and 18 are views similar to Figure 2 showing alternative arrangements according to this invention.

Referring to Figure 1: the support device comprises an inverted U-shaped member 20 having lugs 21 by which it may be attached to a bracket 22 or the chassis of the motor vehicle. The device also comprises a ring 23 mounted within the member 20, the ring 23 being adapted to receive a bearing by which the transmission shaft is directly supported. The bearing may, for example, be a ball or roller bearing in which case the outer race is received within the ring 23. The member 20 constitutes the support member referred to above and the ring 23 constitutes the second member, the ring being supported from the member 20 by means of a member 24 of vibration-absorbing material. Conveniently the member 24 is of natural or synthetic rubber. The member 24 is moulded in the form of a D-ring having a split face, at 25, so that it may be readily passed around the ring 23 whereupon the member 20 is placed in position to secure the D-member 24 in position between the member 20, the bracket 22 and the ring 23. If desired the member 24 may be pre-compressed during assembly.

During manufacture of member 24 it is formed with pockets 26 extending inwardly from its inner surface and with pockets 27 extending inwardly from its outer surface. Alternatively either pockets 26 or 27 may alone be provided. It will be observed that the pockets 26, 27 are staggered and as shown in Figure 2 the sides of the pockets are extended to engage the ring 23 or the member 20 or the bracket 22 as is appropriate. In this way the openings to the pockets are closed so that ingress to the pockets is prevented. Consequently dirt and oil cannot enter the pockets.

As shown in Figure 2 the member 20 is formed with a raised edge at 28, one on each side of the D-member 24, and the upstanding portions of the pockets are held in position by said edges this further ensuring that the member 24 can not be displaced so that dirt and oil enters the pockets.

The pockets may be evenly spaced around the axis 29 as shown or the spacing between adjacent pockets may be different. Moreover, the size of the pockets may be the same or different but in any event it is possible so to select the pockets that any required ratio of stiffness in different directions is obtained.

In Figure 3 there is shown a member 24 in the form of a strip which, according to the construction on the right hand side of the Figure, extends completely around the ring 23, the strip being provided with pockets 26 and 27 as in the construction of Figure 1. The member 24 is held in position around ring 23 by a strap 30 having lugs 31 for attachment to a bracket 32 and by a second strap 33 similarly attached to the bracket 32 by lugs 31*a*.

The construction shown in the left hand side of Figure 3 is generally the same as that shown on the right hand side wherein, however, the member 24 is in two parts comprising a lower strip 34 and an upper strip 35.

The construction shown on the left hand, or right hand, side of Figure 3 may be readily adapted for suspension entirely below brackets 32 by extending the lugs 31, 31*a* upwardly.

In Figure 4 the member 38 of vibration-absorbing material is located between a strap or ring 20 having flared sides 36 and a ring 37 of convex form in cross-section as shown in the drawing. The member 38 has pockets 39 and the sides of the pockets engage with the flared sides 36, the sides of the pockets being somewhat outwardly directed. As in the previous constructions the pockets are sealed against dirt and oil.

It will be observed that the radius *a* of the ring 37 is less than the minimum radius *b* of the flared sides 36 so that, if necessary, the ring 37 may be axially removed from within the strap 20. Alternatively, however,

the dimension *a* may be slightly greater than the dimension *b* so that it is impossible to separate the ring from the member 20 thereby providing a safety device which prevents inadvertent separation of said parts.

In an alternative construction it may be arranged that the ring 37 is formed with a concave face and that the strap 20 has a convex face directed towards the ring 37. Again as in the construction of Figure 4 the radii of the ring and the surrounding strap may be such as to prevent inadvertent axial separation.

In Figure 5 a bearing-carrying ring 40 is provided with an outwardly-projecting circumferential rib 41 and a pair of rings 42 of vibration-absorbing material are provided, each being formed with pockets 43. The rings are held in position, at least in part, by a strap or like member 44 which is provided with inwardly directed edges 45 for this purpose. Again it will be observed that the pockets 43 are completely enclosed against the ingress of dirt and oil. If desired the rings 42 may be bonded or otherwise integrally attached to the ring 40. Such an arrangement is shown in Figure 6 wherein the ring, which is indicated by the reference numeral 46, is formed from a strip, as by rolling, to provide an upstanding rib 47. The rings 42 are held in position as in the construction of Figure 5 the strap or the member not being shown in Figure 6.

In the construction of Figure 5 radius *a* may be greater than radius *b* as shown to prevent inadvertent separation of parts 40, 44.

Figures 7, 8, 9, 10 and 11 diagrammatically illustrate different forms which members 24, 34, 35 and 38 may take. In each of the arrangements shown in Figures 7, 8, 9, 10 and 11 the vibration-absorbing material is preferably in the form of a strip produced by moulding in lengths or in any other known or convenient manner. By production in lengths (and by continuous production) the cost of these strips may be kept low, any required portion being cut from the lengths so produced for use in any particular assembly.

In Figure 12 there is illustrated a strip of vibration-absorbing material comprising blocks 48 joined together by side portions 49, the strip being bonded to a thin metal band 50 thereby to define pockets 53 lying between the side portions 49, the blocks 48 and band 50. A composite strip as shown in Figure 12 may be wrapped around the ring 23 with the metal band 50 against the ring (in the manner of Figure 15) or alternatively the composite strip may be wrapped around the ring with the blocks 49 next to the ring. In the latter arrangement the ring which carries the centre bearing will close the openings to the pockets 53 and in the former arrangement an encircling strap or the like will be provided, as in the previous constructions, to close the pockets.

Figure 13 shows a strip of similar construction to that of Figure 12 wherein, however, there is provided a backing 55 which with blocks 48 and side portions 49 form the pockets 53. The backing 55 is bonded or otherwise attached to band 50.

In Figure 14 a strip of vibration-absorbing material comprises side portions 51 of a synthetic resin material secured to, or held in position by pressure in fitting, a corrugated, castellated or similarly formed base 52 so as to define pockets 54. The material of the portions 51 is selected so as to be particularly resistant to oil and abrasion by dust and dirt while the material of the base 52 is selected because of its load-carrying characteristics. In the arrangement of Figure 14 therefore the features of oil resistance and load-carrying capacity are separately provided for and suitably combined.

It is to be understood that a construction somewhat similar to Figure 14 may be utilised in any of the constructions previously described.

In Figure 15 there is shown a composite strip of vibration-absorbing material, such as that of Figures 12 or 13, wherein the band 50 or backing 55 is wrapped around to form a split ring. Alternatively, the ends of the band or backing may be united to form a hoop and according to yet a further arrangement a strip of material such as of Figures 7 to 10 is mounted upon a complete ring or tube.

In Figures 16, 17 and 18 the strip material is not located between abutments, such as the edges 28 of Figure 2 or the flared sides 36 of Figure 4, but is held in place either by compression of the rubber between the central ring and the encircling strap or the like or alternatively the strip is stitched in such a way that it will firmly engage said parts. With either procedure the strip may additionally be secured to the parts, as by bonding.

It will be understood that the strips of Figures 16, 17 and 18 may be of any convenient shape or form.

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Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1958.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
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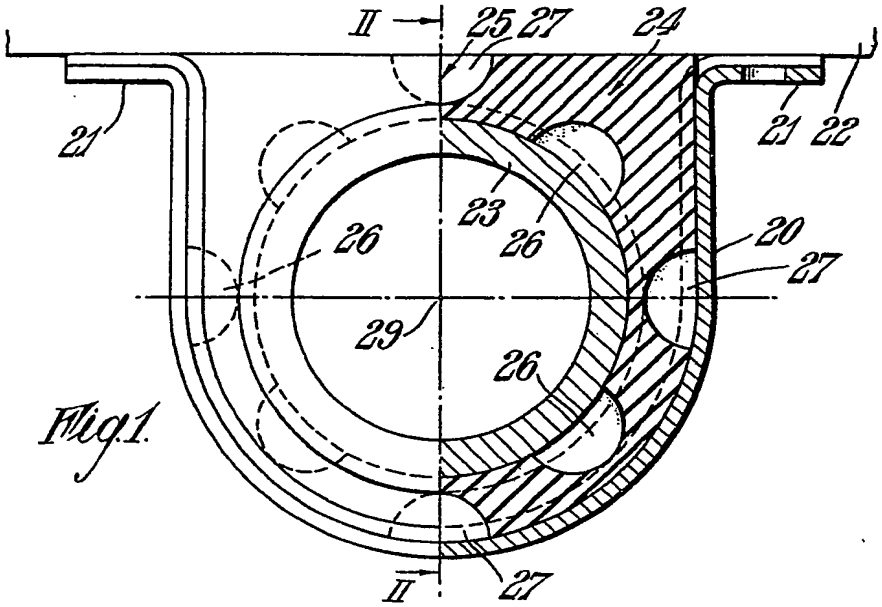
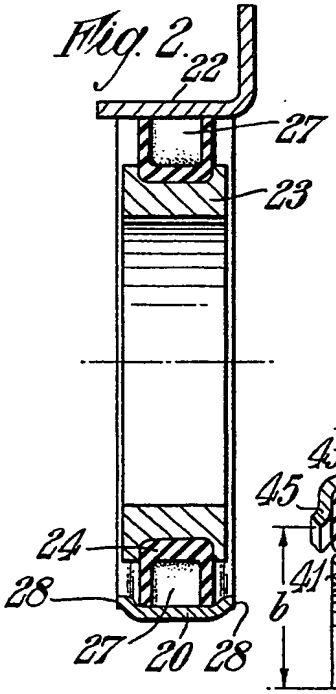


Fig. 1.



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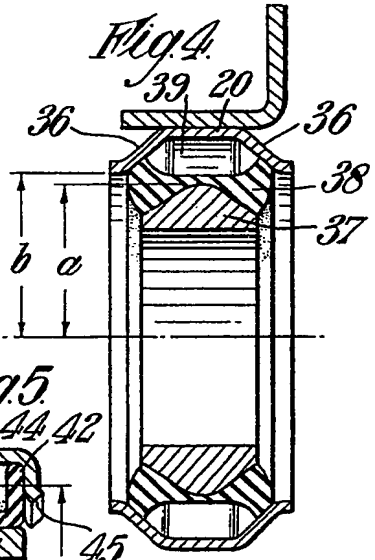

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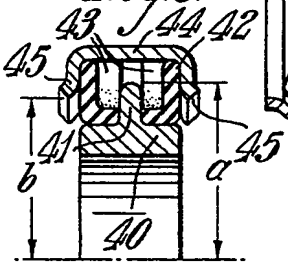
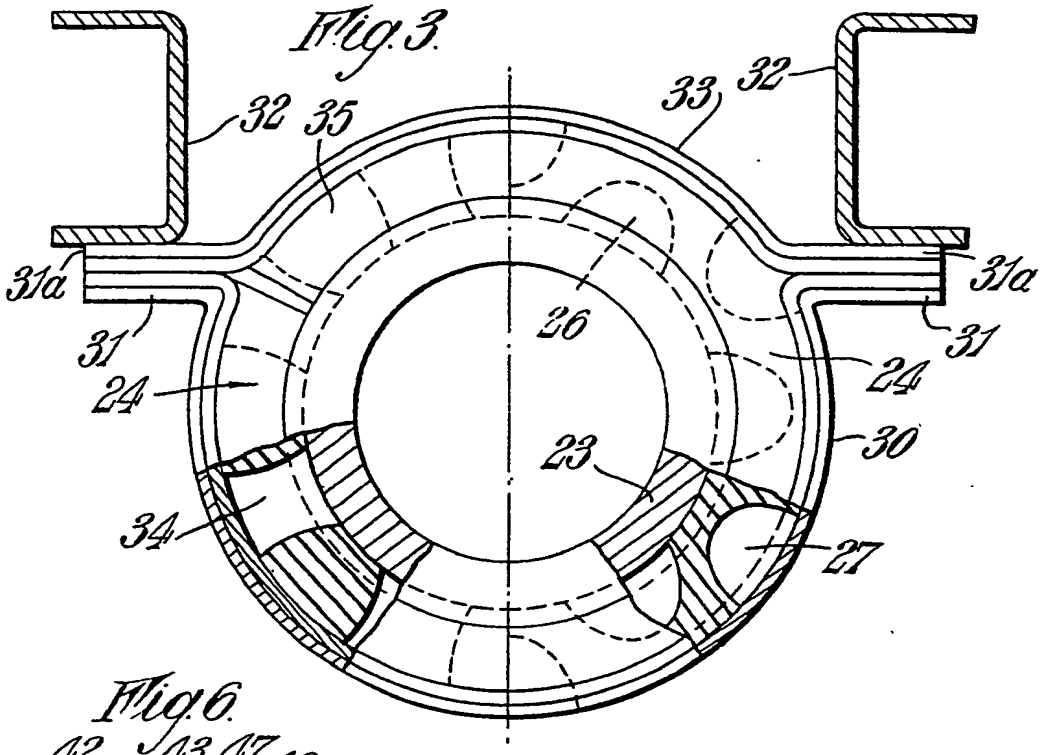


Fig. 5.

Fig. 3.



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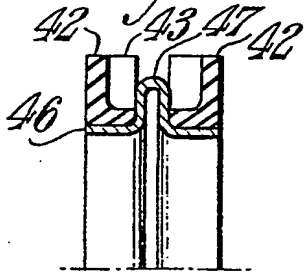

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

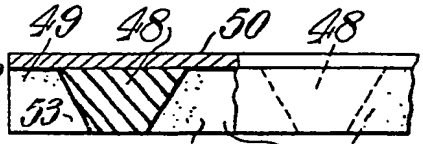

Fig. 12.

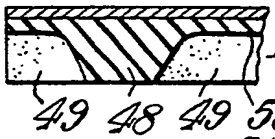

Fig. 13.

Fig. 11.

Fig. 14.

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Fig.3.

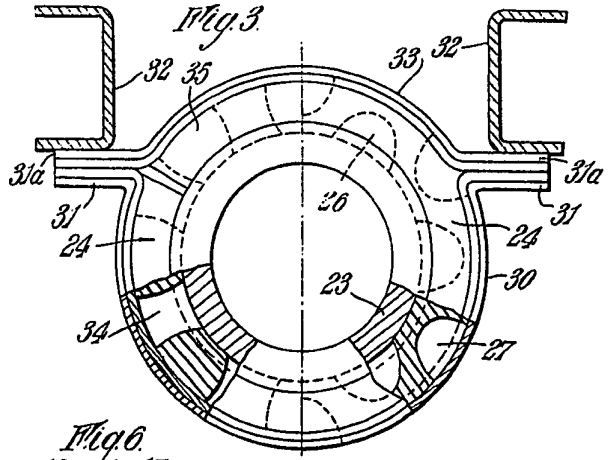


Fig.6.

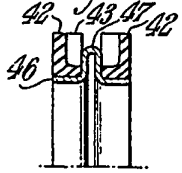


Fig.7.

Fig.8.

Fig.9.

Fig.10.

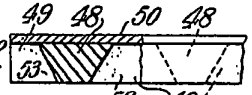


Fig.12.

Fig.13.

Fig.11.

Fig.14.

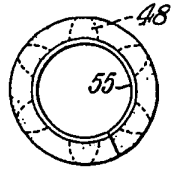
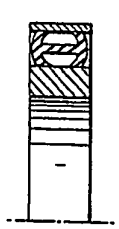


Fig.15.



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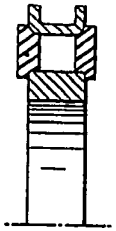

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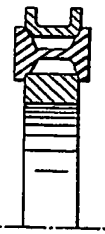

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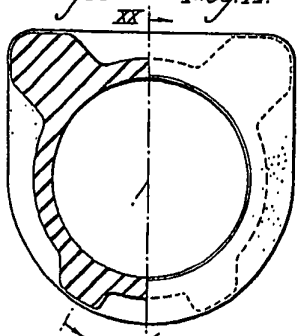


Fig.19.

Fig.20.

797,435 PROVISIONAL SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

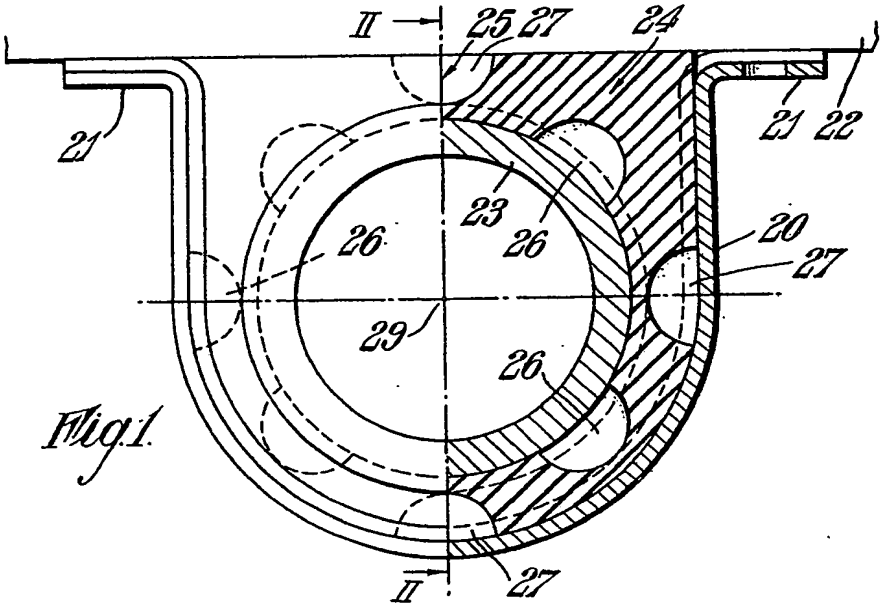
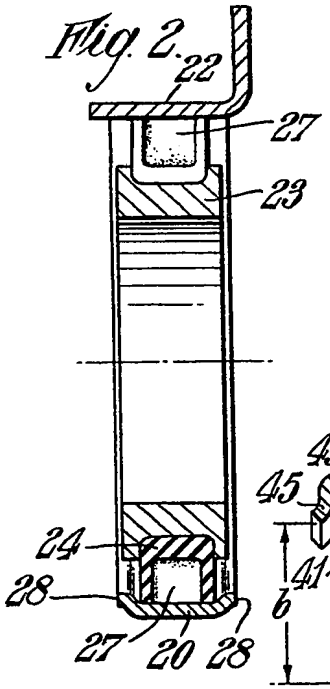


Fig. 1.



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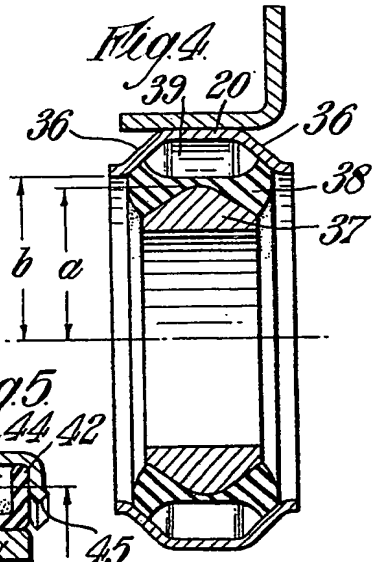

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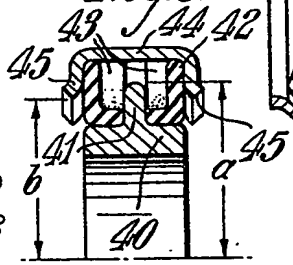
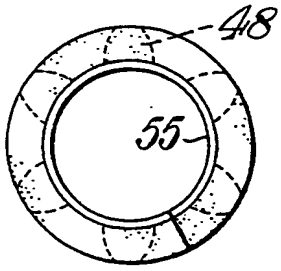


Fig. 5.

797,435 COMPLETE SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEETS 2 & 3



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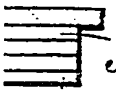

24

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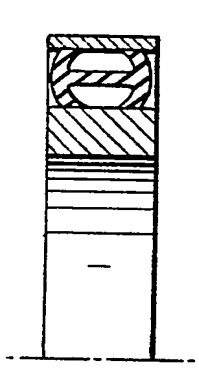

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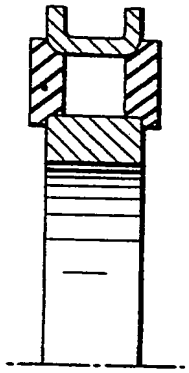

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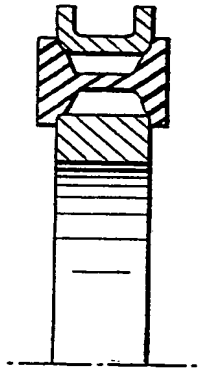


Fig. 18.

Fig. 7.

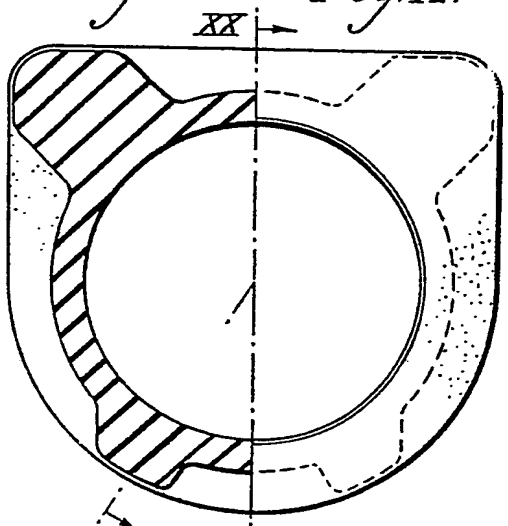
Fig. 8.

Fig. 10.

Fig. 13.

55

Fig. 14.



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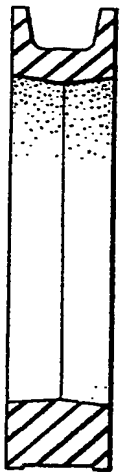
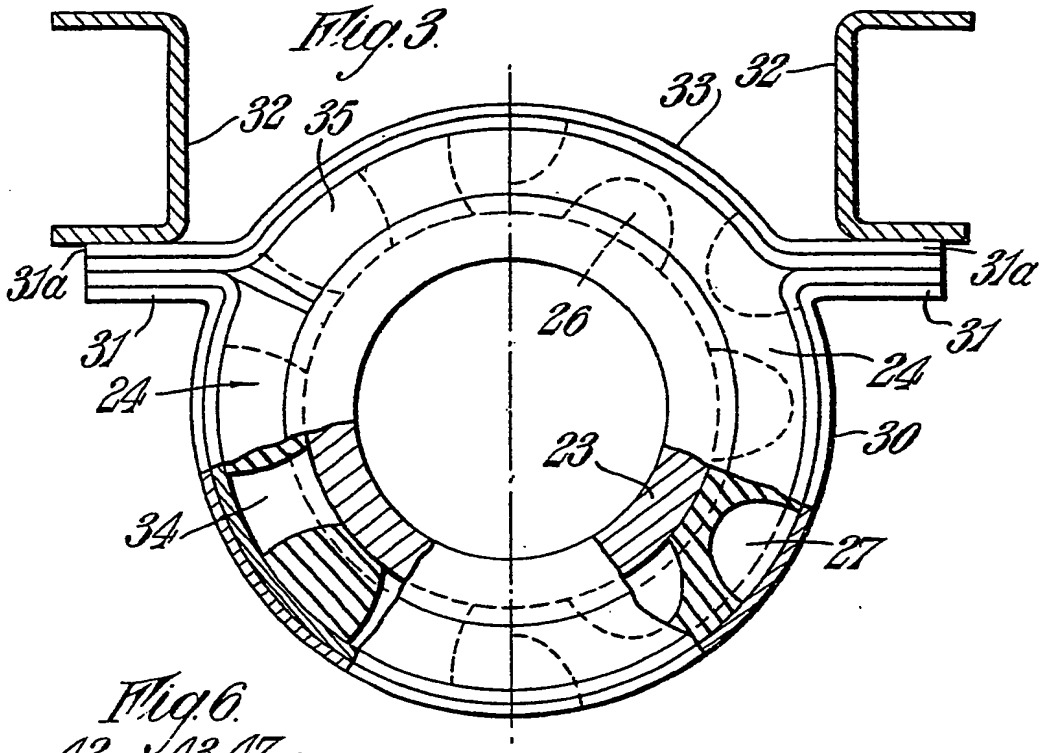


Fig. 20.

Fig. 3.



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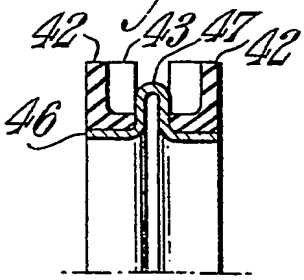
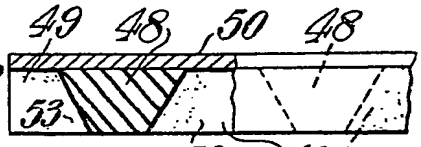


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.



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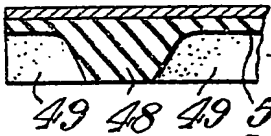

Fig. 13.

Fig. 11.

Fig. 14.

797,435 PROVISIONAL SPECIFICATION
3 SHEETS
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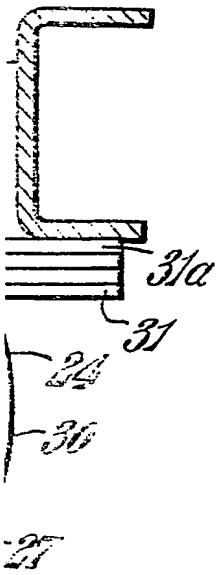
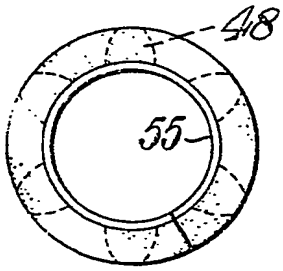
SHEETS 2 & 3





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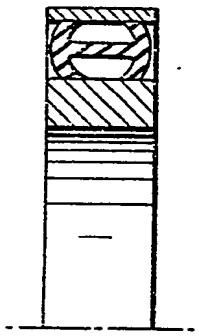

Fig. 16.

Fig. 7.

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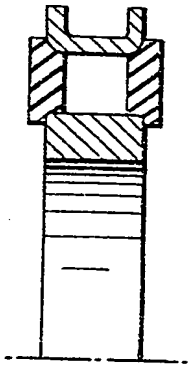
Fig. 14.



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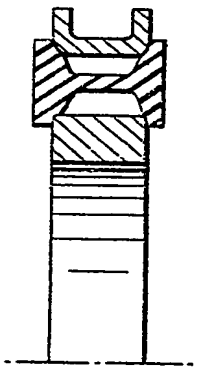
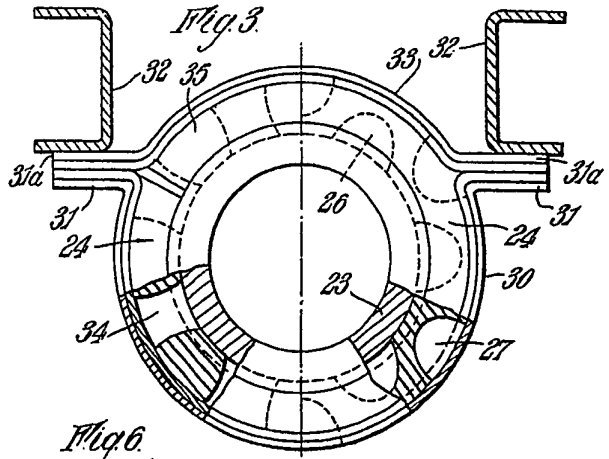
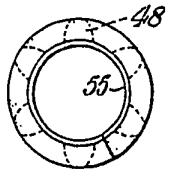


Fig. 18.

797,435 PROVISIONAL SPECIFICA
3 SHEETS This drawing is a reproduct the Original on a reduced
SHEETS 2 & 3

Fig.3.





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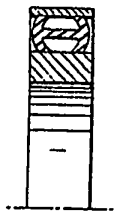

Fig.16.

Fig.6.

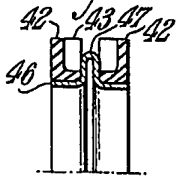

Fig.7.

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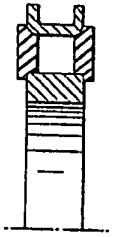

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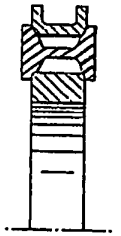

Fig.18.

Fig.12.

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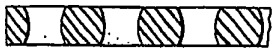

Fig.14.